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PTO/SB/05 (4/98)
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UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 C.F.R. § 1.53(b))

Attorney Docket No.	11366.00001
First Inventor or Application Identifier	Todd M. Poter
Title	Method for Synchronizing Audio and Video Streams
Express Mail Label No.	EL344614915US

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

ADDRESS TO: **Assistant Commissioner for Patents, Box Patent Application, Washington, DC 20231**

1. [✓] * Fee Transmittal Form *(e.g., PTO/SB/17)* *(Submit an original and a duplicate for fee processing)*
2. [✓] Specification [*Total Pages* 26]
   (preferred arrangement set forth below)
   - Descriptive title of the Invention
   - Cross References to Related Applications
   - Statement Regarding Fed sponsored R & D
   - Reference to Microfiche Appendix
   - Background of the Invention
   - Brief Summary of the Invention
   - Brief Description of the Drawings *(if filed)*
   - Detailed Description
   - Claim(s)
   - Abstract of the Disclosure
3. [✓] Drawing(s) *(35 U.S.C. 113)* [*Total Sheets* 5]
4. Oath or Declaration [*Total Pages* 2]
   a. [✓] Newly executed (original or copy)
   b. [ ] Copy from a prior application (37 C.F.R. § 1.63(d)) *(for continuation/divisional with Box 16 completed)*
      i. [ ] DELETION OF INVENTOR(S) Signed statement attached deleting inventor(s) named in the prior application, see 37 C.F.R. §§ 1.63(d)(2) and 1.33(b).

** NOTE FOR ITEMS 1 & 13: IN ORDER TO BE ENTITLED TO PAY SMALL ENTITY FEES, A SMALL ENTITY STATEMENT IS REQUIRED (37 C.F.R. § 1.27), EXCEPT IF ONE FILED IN A PRIOR APPLICATION IS RELIED UPON (37 C.F.R. § 1.28).*

5. [ ] Microfiche Computer Program *(Appendix)*
6. Nucleotide and/or Amino Acid Sequence Submission *(if applicable, all necessary)*
   a. [ ] Computer Readable Copy
   b. [ ] Paper Copy (identical to computer copy)
   c. [ ] Statement verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

7. [ ] Assignment Papers (cover sheet & document(s))
8. [ ] 37 C.F.R.§3.73(b) Statement *(when there is an assignee)* [ ] Power of Attorney
9. [ ] English Translation Document *(if applicable)*
10. [✓] Information Disclosure Statement (IDS)/PTO-1449 [ ] Copies of IDS Citations
11. [ ] Preliminary Amendment
12. [✓] Return Receipt Postcard (MPEP 503) *(Should be specifically itemized)*
13. [✓] * Small Entity Statement(s) *(PTO/SB/09-12)* [ ] Statement filed in prior application, Status still proper and desired
14. [ ] Certified Copy of Priority Document(s) *(if foreign priority is claimed)*
15. [ ] Other: .....

16. **If a CONTINUING APPLICATION,** *check appropriate box, and supply the requisite information below and in a preliminary amendment:*
    [ ] Continuation [ ] Divisional [ ] Continuation-in-part (CIP) of prior application No: _____/_____
    Prior application information: *Examiner* _____ *Group / Art Unit:* _____
    For CONTINUATION or DIVISIONAL APPS only: The entire disclosure of the prior application, from which an oath or declaration is supplied under Box 4b, is considered a part of the disclosure of the accompanying continuation or divisional application and is hereby incorporated by reference. The incorporation can only be relied upon when a portion has been inadvertently omitted from the submitted application parts.

17. CORRESPONDENCE ADDRESS

[ ] *Customer Number or Bar Code Label* *(Insert Customer No. or Attach bar code label here)* *or* [✓] *Correspondence address below*

Name	David C. Cain				
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Name (Print/Type)	David C. Cain	*Registration No. (Attorney/Agent)*	45,337
Signature	David C Cain	*Date*	9-19-00

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FEE TRANSMITTAL for FY 1999

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TOTAL AMOUNT OF PAYMENT ($) 510.00

Complete if Known	
Application Number	Not Assigned
Filing Date	Not Assigned
First Named Inventor	Todd M. Poter
Examiner Name	Not Assigned
Group / Art Unit	Not Assigned
Attorney Docket No.	11366.00001

METHOD OF PAYMENT (check one)

1. [X] The Commissioner is hereby authorized to charge indicated fees and credit any over payments to:

Deposit Account Number: 20-0821

Deposit Account Name: Thompson & Knight

[X] Charge Any Additional Fee Required Under 37 CFR §§ 1 16 and 1.17

2. [X] **Payment Enclosed:** [X] Check [ ] Money Order [ ] Other

FEE CALCULATION

1. BASIC FILING FEE

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
101	760	201	380	Utility filing fee	345
106	310	206	155	Design filing fee	
107	480	207	240	Plant filing fee	
108	760	208	380	Reissue filing fee	
114	150	214	75	Provisional filing fee	

SUBTOTAL (1) ($) 345

2. EXTRA CLAIM FEES

		Extra Claims		Fee from below		Fee Paid
Total Claims	34	-20** =	14	X 9	=	126
Independent Claims	4	- 3** =	1	X 39	=	39
Multiple Dependent					=	

**or number previously paid, if greater; For Reissues, see below

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description
103	18	203	9	Claims in excess of 20
102	78	202	39	Independent claims in excess of 3
104	260	204	130	Multiple dependent claim, if not paid
109	78	209	39	** Reissue independent claims over original patent
110	18	210	9	** Reissue claims in excess of 20 and over original patent

SUBTOTAL (2) ($) 165

FEE CALCULATION (continued)

3. ADDITIONAL FEES

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
105	130	205	65	Surcharge - late filing fee or oath	
127	50	227	25	Surcharge - late provisional filing fee or cover sheet	
139	130	139	130	Non-English specification	
147	2,520	147	2,520	For filing a request for reexamination	
112	920*	112	920*	Requesting publication of SIR prior to Examiner action	
113	1,840*	113	1,840*	Requesting publication of SIR after Examiner action	
115	110	215	55	Extension for reply within first month	
116	380	216	190	Extension for reply within second month	
117	870	217	435	Extension for reply within third month	
118	1,360	218	680	Extension for reply within fourth month	
128	1,850	228	925	Extension for reply within fifth month	
119	300	219	150	Notice of Appeal	
120	300	220	150	Filing a brief in support of an appeal	
121	260	221	130	Request for oral hearing	
138	1,510	138	1,510	Petition to institute a public use proceeding	
140	110	240	55	Petition to revive - unavoidable	
141	1,210	241	605	Petition to revive - unintentional	
142	1,210	242	605	Utility issue fee (or reissue)	
143	430	243	215	Design issue fee	
144	580	244	290	Plant issue fee	
122	130	122	130	Petitions to the Commissioner	
123	50	123	50	Petitions related to provisional applications	
126	240	126	240	Submission of Information Disclosure Stmt	
581	40	581	40	Recording each patent assignment per property (times number of properties)	
146	760	246	380	Filing a submission after final rejection (37 CFR § 1 129(a))	
149	760	249	380	For each additional invention to be examined (37 CFR § 1 129(b))	

Other fee (specify) _____

Other fee (specify) _____

* Reduced by Basic Filing Fee Paid

SUBTOTAL (3) ($)

SUBMITTED BY				Complete (if applicable)	
Name (Print/Type)	David C. Cain	Registration No (Attorney/Agent)	45,337	Telephone	214-969-1165
Signature	David C Cain			Date	9-18-00

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STATEMENT CLAIMING SMALL ENTITY STATUS (37 CFR 1.9(f) & 1.27(b))--INDEPENDENT INVENTOR	Docket Number (Optional) 11366.00001

Applicant, Patentee, or Identifier: Todd M. Porter

Application or Patent No.: _____

Filed or Issued: _____

Title: Method for Synchronizing Audio and Video Streams

As a below named inventor, I hereby state that I qualify as an independent inventor as defined in 37 CFR 1.9(c) for purposes of paying reduced fees to the Patent and Trademark Office described in:

- [x] the specification filed herewith with title as listed above.
- [ ] the application identified above.
- [ ] the patent identified above.

I have not assigned, granted, conveyed, or licensed, and am under no obligation under contract or law to assign, grant, convey, or license, any rights in the invention to any person who would not qualify as an independent inventor under 37 CFR 1.9(c) if that person had made the invention, or to any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e).

Each person, concern, or organization to which I have assigned, granted, conveyed, or licensed or am under an obligation under contract or law to assign, grant, convey, or license any rights in the invention is listed below:

- [x] No such person, concern, or organization exists.
- [ ] Each such person, concern, or organization is listed below.

Separate statements are required from each named person, concern, or organization having rights to the invention stating their status as small entities. (37 CFR 1.27)

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

Todd M. Porter		
NAME OF INVENTOR	NAME OF INVENTOR	NAME OF INVENTOR
Signature of inventor	Signature of inventor	Signature of inventor
9/14/00		
Date	Date	Date

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SPECIFICATION

Attorney Docket No. **11366.00001**

TO ALL WHOM IT MAY CONCERN:

BE IT KNOWN that I, Todd M. Porter, a United States citizen, residing in the city of Dallas, Texas, have invented new and useful improvements in a

METHOD FOR SYNCHRONIZING AUDIO AND VIDEO STREAMS

of which the following is a specification:

"EXPRESS MAIL" No. EL 344614915US
Date of Deposit: September 19, 2000
I hereby certify that this paper or fee is being deposited with the United States Postal Service Express Mail "Post Office to Addressee" service under 37 C.F.R. §1.10 on the date indicated above and is addressed to the Honorable Commissioner of Patents & Trademarks, Washington, Box Patent Application, D.C. 20231-9998, by Sue F. Kirby

METHOD FOR SYNCHRONIZING AUDIO AND VIDEO STREAMS

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates in general to a method for synchronizing elementary audio and video streams and in particular to a software system executed on a computer for synchronizing audio and video streams during a video editing process.

2. Description of Related Art

The rapid development of electronic hardware and software has spawned a digital revolution. Video and audio production and transmission are technologies that have certainly benefitted from the effects of the digital age. By converting audio and video files to a digital format, the files can be easily transferred and copied many times with little or no degradation of the original recording quality.

Both audio and video files require large amounts of data to accurately represent the audio or video associated with the files. Since file transfer speed and computer processing speed are usually a concern, it is desired to reduce the file size of audio and video files as much as possible. File reduction is accomplished by using the process of compression. Compression saves storage space and transmission time. Compression processes take advantage of the fact that information

exhibits order and patterning. When order and patterning can be extracted from a group of information, the information can be represented and transmitted using less data than needed for the original information.

One of the most straightforward ways to compress data is to recognize pattern structures within the data set and replace the patterns with shorter data sets that express the pattern structure. The most common compression of this sort is called "run-length encoding." Certain types of data, and in particular visual data, often include long strings of ones (or zeroes), to express an unvarying condition. Run length encoding searches for "runs" of a single data type, and creates a code that expresses the length of the run, as well as the parity of the bits. As an oversimplified example, the data set "0000 0000" could be compressed as "8 0," signifying eight bits with a parity of zero, while the data set "1111 1111" could be compressed as "8 1"

Video data can also be compressed by recognizing patterns that naturally occur because of the way video is formatted. For example, sometimes video includes scenes where the visual image is unchanged for several frames or more. The data representing the repeated video frame may be too complex for run-length or other forms of compression within the frame, but substantial compression can still be obtained by writing the frame data once, and adding code to represent the number of times the frame is repeated.

Another form of video compression takes advantage of the tendency in video (especially on a frame-by-frame level) to avoid abrupt changes in the visual image that is generated. Rather, each frame is in most cases very similar to the frame that came before and to the one that will follow. Video compression can be achieved by fully representing a first frame and then

appending data to represent each bit of data that changed in the next frame. This can be continued for each frame, perhaps until noting the changes in a frame requires more data than writing the frame out fully, at which point the compression process can begin again with the new frame as a starting point.

Compression is often described as being "lossless" or "lossy." Lossless compression removes redundant information. An example of lossless compression is run-length encoding. As mentioned previously, no information is discarded in run-length encoding; rather, information is just rearranged and represented in a more efficient manner.

The goal of lossy compression is to remove irrelevant information. Lossy compression relies on the fact that some information in an original video stream cannot be perceived by a person viewing the video. A lossy compression algorithm will remove these imperceptible pieces of information. Lossy compression will sometimes also remove information that is "close to irrelevant" if it is determined that the benefit of the data savings outweighs the detriment caused by the perceived loss in quality.

A common compression format for video files is the MPEG-2 standard, which was developed by the Moving Picture Experts Group. FIG. 1 schematically illustrates a segment of an MPEG-2 video file 11 and an AC-3 audio file 13. Video file 11 and its corresponding audio file 13 are representative of elementary video and audio files that have undergone compression. Video files, such as file 11, that have been compressed by the MPEG-2 standard are variable bit rate files. Variable bit rate files are files that may have different amounts of data associated with each second of video. When the frames in a portion of a video steam are very similar to

surrounding frames, less memory is needed to accurately represent those frames than when the frames are very different from the surrounding frames. Hence, the allocation of bits to a particular segment of video can vary at different places in the video. Audio compression is accomplished using a constant bit rate process, wherein the same number of bits are allocated to each second of audio.

Video file 11 has twelve seconds of video stored in 1,000,000 bytes. Audio file 13, which is a constant bit rate file, has nine seconds of audio stored in the same 1,000,000 bytes. In order to properly play video file 11 and audio file 13, it is desired to have the sound of the audio file "synchronized" with the video of the video file. Therefore, any sound at the sixth second of the audio file should be played simultaneous with any video at the sixth second of the video file.

As long as both files are started from the beginning, the video and audio are synched. The problem arises when a user attempts to "jump" to a particular portion of the audio and video. Jumping to a particular point in the audio and video files is necessary in any non-linear editing environment. Users attempting to edit video commonly need to fast-forward to a given point in the audio and video streams and play from that point.

Most applications currently available for non-linear editing assume that a given file size yields a given number of seconds of video and audio. When a user attempts to fast-forward to a desired in-point in the video and audio files, the user generally indicates the desired in-point by entering a time position, which represents the amount of time elapsed in the video or audio file. The application then uses a formula to calculate the desired in-point in terms of bytes. The formula takes the time position entered by the user and multiplies it by the length (in bytes) of

each second of audio and video. This formula based approach works fine for uncompressed audio and video files and compressed audio files where the files are arranged with a constant bit rate. However, a formula based approach does not work properly on compressed video files, which are variable bit rate.

Referring still to FIG. 1, an arrow 15 illustrates the result of using the formula-based approach to calculate an in-point for a user-defined time position. The prior art software represented in FIG. 1 has attempted to fast-forward both video file 11 and audio file 13 to an in-point just prior to the ninth second of audio and video. Since audio file 13 is a constant bit rate file, the calculation quickly identifies the correct byte location for the ninth second of audio. However, since video file 11 has a variable number of bytes associated with each second of video, the calculation wrongly identifies the eleventh second of video as being the correct in-point. If the files were played from the in-points represented by arrow 15, the ninth second of audio would play simultaneously with the eleventh second of video. As can be appreciated by those persons skilled in the art, this is not a desired result. The playback of the audio and video from these in-points is "unsynched." Specifically, the video represented in FIG. 1 would appear to be slightly ahead of the audio, which would result in any spoken dialogue lagging behind the movements of a person's mouth.

A need exists, therefore, for a method for synchronizing elementary video and audio steams, where the video stream is represented by a variable bit rate file.. A need also exists for software to organize and process the video stream prior to a first playing of the video stream so that the video stream can be easily synchronized with the audio stream.

BRIEF SUMMARY OF THE INVENTION

It is a general object of the present invention to provide a method for synchronizing an elementary audio stream with an elementary video stream. The audio stream is contained in a constant bit rate audio file, while the video stream is contained in a variable bit rate video file. The present invention is achieved by sampling a plurality of markers within the video file. As each marker is sampled, a time stamp and a memory stamp for the marker are recorded in a group of video pictures table (GVP table). The GVP table is typically created when the video file is loaded for the first time using software incorporating the method of the present invention. After creating the GVP table once, the GVP table can be accessed for any future synchronization needs associated with the video file.

When a user wishes to "jump" to a particular in-point in the video file, the user indicates a selected time position at which he wishes the video to begin playing. A video byte location is found by scanning the GVP table for the time stamp that matches the selected time position. When the time stamp is located, the corresponding memory stamp is the video byte location.

Since the audio file is a constant bit rate file, an audio byte location can be calculated based on the selected time position provided by the user. The audio byte location represents a location in the audio file that would allow synchronization of the audio and video streams if the audio file was played from the audio byte location and the video file was played from the video byte location. The audio byte location is calculated by multiplying a total bytes value for the audio file by the selected time position and then dividing this product by a total time value for

the audio file.

After finding the audio byte location and the video byte location, the audio and video streams can be played synchronously by starting the audio file at the audio byte location and concurrently starting the video file at the video byte location.

Other objects, features, and advantages of the present invention will become apparent with reference to the drawings and detailed description which follow.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 schematically illustrates an MPEG-2 video file and an AC-3 audio file being used with a prior art method which attempts to synchronize elementary audio and video streams.

FIG. 2 schematically illustrates an MPEG-2 video file and an AC-3 audio file being used with a method of synchronizing elementary audio and video streams according to the present invention.

FIG. 3 illustrates a GVP table which is created by the method of FIG. 2.

FIG. 4 illustrates a screen shot of a software program executed by a computer for performing the method of FIG. 2.

FIG. 5 illustrates a screen shot of a software program executed by a computer for performing the method of FIG. 2, the software program being shown in the process of building the GVP table of FIG. 3.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

In the following detailed description of the preferred embodiments, reference is made to the accompanying drawings which form a part hereof, and in which is shown by way of illustration specific preferred embodiments in which the invention may be practiced. These embodiments are described in sufficient detail to enable those skilled in the art to practice the invention, and it is understood that other embodiments may be utilized and that logical mechanical, electrical, and software changes may be made without departing from the spirit or scope of the invention. To avoid detail not necessary to enable those skilled in the art to practice the invention, the description may omit certain information known to those skilled in the art. The following detailed description is, therefore, not to be taken in a limiting sense, and the scope of the present invention is defined only by the appended claims.

Referring to FIG. 2 in the drawings, an MPEG-2 video file 21 and an AC-3 audio file 23 are illustrated. Similar to the files shown in FIG. 1, video file 21 and audio file 23 are representative of elementary video and audio files that have undergone compression. Video file 21 has twelve seconds of video stored in 1,000,000 bytes, while audio file 23 has nine seconds of audio stored in the same 1,000,000 bytes.

A plurality of arrows 25 show the general result of using the method of the present invention. Instead of incorrectly synchronizing the video and audio as shown in FIG. 1, the method of the present invention allows each second of video to be correctly synchronized with the corresponding second of audio. In other words, when a user desires to view video at the

ninth second of video file 21, the video will be played synchronously with the ninth second of audio from audio 23.

Every video file consists of a plurality of frames which are played in a particular order to create an illusion of motion. The present invention takes advantage of certain aspects of an MPEG-2 video format and the organization of frames within an MPEG-2 file. MPEG-2 files use markers called Groups of Pictures (GOP) to organize and arrange the frames within a video stream. Each GOP is a collection of single frames of video with a timestamp. For Digital Versatile Discs (DVDs), the MPEG-2 specification requires that no more than sixteen frames of video can be contained in any one GOP. Since one second of full motion video contains approximately thirty frames, it can be roughly stated that each GOP represents approximately one-half second of video.

Referring to Figure 3 in the drawings, a GVP table 31 is a linear table that lists a time stamp 33 for each GOP and a corresponding memory stamp 35, which represents the byte location of that GOP in the video file. GVP table 31 is created by the method of the present invention when the MPEG-2 video file is loaded for the first time. During the initial loading, the video file is scanned, and the time stamp 33 and memory stamp 35 for each GOP are recorded in GVP table 31.

Because of the creation of GVP table 31, an initial delay is encountered during the first loading of the video file. However, for any subsequent uses of the same video file on the same computer, it is not necessary to recreate GVP table 31. GVP table 31 has a relatively small memory "footprint," taking up approximately 120,000 bytes of memory for every one hour of

video.

Although the present invention has been described in terms of the structure of an MPEG-2 video file, the method could be used with any variable bit rate video file. The only requirement is that the file contain some provision for time stamping different portions of the video. A GVP table would be built based on the time stamps within the video and their corresponding byte locations.

Although the method of the present invention could be used in any application where it is desired to synchronize a variable bit rate video file with an audio file, the method is preferably used with DVD authoring software executed by a computer. Referring to FIGS. 4 and 5 in the drawings, a screen shot of a DVD authoring package 41 is illustrated. DVD authoring package 41 is used to assemble and edit the various audio, video, and text components that will be added to a DVD. Most commonly, the audio and video that will be added to a DVD are represented by two separate files, one file containing an elementary audio stream and another file containing an elementary video stream. When creating the DVD, a user adds features such as chapters and subtitles at certain points in the video. To correctly position these features, it is highly desirous for the user to be able to move through the video stream while listening to the audio stream. The process of moving through the video stream in this way is referred to as "scrubbing."

As is common with many DVD authoring packages, DVD authoring package 41 includes a hierarchal structure 43 of the DVD being created and a video viewing area 45 for viewing video streams which are being added to the DVD. Also included are provisions for adding and editing chapters 47, subtitles 49, prohibitions 51, and navigation features 53.

A user begins the authoring process by loading an audio file at an active audio box 55 and a video file at an active video box 57. When the video file is first loaded into DVD authoring package 41, a GVP table 31 is created. As illustrated in FIG. 5, the creation of GVP table 31 is indicated by a progress report screen 59. After creating GVP table 31, the user can easily scrub to different portions of the video in order to add features to the DVD. The user indicates an in-point in the video file by dragging a video scrub bar 61. By dragging video scrub bar 61 to a particular point, the user has effectively entered a selected time position for the video file. The DVD authoring package 41 takes the selected time position provided by the user and searches the time stamps 33 listed in GVP table 31. After a time stamp 33 has been found that matches the selected time position, the memory stamp 35 associated with that time stamp 33 is recorded as a video byte location. A frame in the video at that video byte location is then displayed in video viewing area 45. Simultaneously, a time stamp indicator 63 displays the selected time position.

DVD authoring package 41 calculates an audio byte location based on the selected time position chosen by the user. The audio byte location represents a location in the audio file that would allow the audio and video streams to be synchronized, if the audio file was played from the audio byte location and the video file was played from the video byte location. The audio byte location is calculated by multiplying a total bytes value for the audio file by the selected time position. This product is then divided by a total time value for the audio file. The total bytes value represents the total number of bytes occupied by the audio file, while the total time value is the total amount of time required to play the audio file.

After a user has chosen the selected time position by dragging video scrub bar 61, the

user can release video scrub bar 61 to begin playing the video and audio file. The video begins playing at the video byte location and is displayed in video viewing area 45. Simultaneously, the audio file begins to play at the audio byte location and can be heard by the user as the user watches the video.

The primary advantage of the present invention is that it allows synchronization of a variable bit rate video file with any audio file. During video editing, especially during DVD authoring, it is highly desirous to be able to scrub to any point in a video and have the video and audio play synchronously from that point.

Another advantage of the present invention is that it creates a GVP table upon an initial loading of a video file. The creation of the GVP table prevents lengthy search periods which would alternatively be performed in order to find a proper GOP for a selected time stamp. Since the GVP table is stored, a particular video file can be edited on many different occasions without having to recreate the GVP.

It should be apparent from the foregoing that an invention having significant advantages has been provided. While the invention is shown in only one of its forms, it is not just limited but is susceptible to various changes and modifications without departing from the spirit thereof.

CLAIMS

I claim:

1. A method for synchronizing an elementary audio stream with an elementary video stream, the video stream having a plurality of markers containing information for displaying frames associated with the video stream, the method comprising the steps of:

sampling the markers in the video stream to obtain a time stamp and a memory stamp for each marker, the time stamp indicating a time position of the marker in the video stream, the memory stamp indicating a relative byte location for the marker in the video stream;

storing values of the time stamp and the memory stamp for each marker;

finding a video byte location in the video stream for a selected time position by reviewing stored values of the time stamps and memory stamps;

finding an audio byte location in the audio stream for the selected time position; and

whereby the audio and video streams are synchronized for output at the audio byte location and the video byte location.

2. The method according to claim 1 further comprising the step of:

receiving input from a user to indicate the selected time position.

3. The method according to claim 1 further comprising the step of:

simultaneously playing the video stream and the audio stream by starting the video stream at the video byte location and starting the audio stream at the audio byte location.

4. The method according to claim 1 further comprising the steps of:

building a table with the stored values of the time stamps and the memory stamps associated with each marker during an initial sampling of the video stream; and

storing the table such that the table can be accessed for any subsequent synchronization operations involving the video stream.

5. The method according to claim 1, wherein the elementary video stream is a variable bit rate file.

6. The method according to claim 1, wherein the elementary video stream is an MPEG-2 file.

7. The method according to claim 1 further comprising:

building a GVP table with the stored values of the time stamps and the memory stamps associated with each marker during an initial sampling of the video stream; and

storing the GVP table such that the GVP table can be accessed for any subsequent synchronization operations involving the video stream; and wherein

the elementary video stream is an MPEG-2 file; and

the markers are GOP markers.

8. The method according to claim 1, wherein the elementary audio stream is a constant bit rate file.

9. The method according to claim 1, wherein the step of finding an audio byte location in the audio stream further comprises the steps of:

determining a total time value for the audio stream that represents an amount of time required to play the entire audio stream at a selected speed;

determining a total bytes value for the audio stream that represents the total number of bytes occupied by the audio stream; and

calculating the audio byte location by multiplying the total bytes value by the selected time position and dividing by the total time value.

10. A method for synchronizing an elementary audio stream with an MPEG-2 video stream, the MPEG-2 video stream having a plurality of GOP markers, each GOP marker containing information for displaying a plurality of frames associated with that GOP marker, the method comprising the steps of:

sampling at least two of the GOP markers in the video stream to obtain a time stamp and a memory stamp for each GOP marker, the time stamp indicating a time position of the GOP marker in the video stream, the memory stamp indicating a relative byte location for the GOP marker in the video stream;

storing values of the time stamp and the memory stamp for each GOP marker in a GVP table;

finding a video byte location for a selected time position by reviewing the GVP table;

finding an audio byte location for the selected time position; and

whereby the audio and video streams are synchronized for output at the audio byte location and the video byte location.

11. The method according to claim 10 further comprising the step of receiving input from a user to indicate the selected time position.

12. The method according to claim 10 further comprising the step of:

simultaneously playing the video stream and the audio stream by starting the video stream at the video byte location and starting the audio stream at the audio byte location.

13. The method according to claim 10 further comprising the steps of:

building the GVP table during an initial sampling of the video stream; and

storing the GVP table such that the GVP table can be accessed for any subsequent synchronization operations involving the video stream.

14. The method according to claim 10, wherein the elementary video stream is a variable bit rate file.

15. The method according to claim 10, wherein the elementary audio stream is a constant bit rate file.

16. The method according to claim 10 wherein the step of finding an audio byte location further comprises the steps of:

determining a total time value for the audio stream that represents an amount of time required to play the entire audio stream at a selected speed;

determining a total bytes value for the audio stream that represents the total number of bytes occupied by the audio stream; and

calculating the audio byte location by multiplying the total bytes value by the selected time position and dividing by the total time value.

17. A data processing system comprising a processor and a memory unit, wherein the data processing system performs the steps of:

sampling a plurality of markers in a video stream to obtain a time stamp and a memory stamp for each marker, the time stamp indicating a time position of the marker in the video stream, the memory stamp indicating a relative byte location for the marker in the video stream;

storing values of the time stamp and the memory stamp for each marker;

finding a video byte location in the video stream for a selected time position by reviewing stored values of the time stamps and memory stamps;

finding an audio byte location in an audio stream for the selected time position; and

whereby the audio and video streams are synchronized for output at the audio byte location and the video byte location.

18. The data processing system according to claim 17 further comprising the step of:

receiving input from a user to indicate the selected time position.

19. The data processing system according to claim 17 further comprising the step of:

simultaneously playing the video stream and the audio stream by starting the video stream at the video byte location and starting the audio stream at the audio byte location.

20. The data processing system according to claim 17 further comprising the steps of:

building a table with the stored values of the time stamps and the memory stamps associated with each marker during an initial sampling of the video stream; and

storing the table such that the table can be accessed for any subsequent synchronization operations involving the video stream.

21. The data processing system according to claim 17, wherein the elementary video stream is a variable bit rate file.

22. The data processing system according to claim 17, wherein the elementary video stream is an MPEG-2 file.

23. The data processing system according to claim 17 further comprising the steps of:

building a GVP table with the stored values of the time stamps and the memory stamps associated with each marker during an initial sampling of the video stream; and

storing the GVP table such that the GVP table can be accessed for any subsequent synchronization operations involving the video stream; and wherein

the elementary video stream is an MPEG-2 file; and

the markers are GOP markers.

24. The data processing system according to claim 17, wherein the elementary audio stream is a constant bit rate file.

25. The data processing system according to claim 17, wherein the step of finding an audio byte location in the audio stream further comprises the steps of:

determining a total time value for the audio stream that represents an amount of time required to play the entire audio stream at a selected speed;

determining a total bytes value for the audio stream that represents the total number of bytes occupied by the audio stream; and

calculating the audio byte location by multiplying the total bytes value by the selected time position and dividing by the total time value.

26. A software program product stored on a computer readable medium comprising:

instructions for sampling a plurality of markers in a video stream to obtain a time stamp and a memory stamp for each marker, the time stamp indicating a time position of the marker in the video stream, the memory stamp indicating a relative byte location for the marker in the video stream;

instructions for storing values of the time stamp and the memory stamp for each marker;

instructions for finding a video byte location in the video stream for a selected time position by reviewing stored values of the time stamps and memory stamps;

instructions for finding an audio byte location in an audio stream for the selected time position; and

whereby the audio and video streams are synchronized for output at the audio byte location and the video byte location.

27. The software program product according to claim 26 further comprising:

instructions for receiving input from a user to indicate the selected time position.

28. The software program product according to claim 26 further comprising:

instructions for simultaneously playing the video stream and the audio stream by starting the video stream at the video byte location and starting the audio stream at the audio byte location.

29. The software program product according to claim 26 further comprising:

instructions for building a table with the stored values of the time stamps and the memory stamps associated with each marker during an initial sampling of the video stream; and

instructions for storing the table such that the table can be accessed for any subsequent synchronization operations involving the video stream.

30. The software program product according to claim 26, wherein the elementary video stream is a variable bit rate file.

31. The software program product according to claim 26, wherein the elementary video stream is an MPEG-2 file.

32. The software program product according to claim 26 further comprising:

instructions for building a GVP table with the stored values of the time stamps and the memory stamps associated with each marker during an initial sampling of the video stream; and

instructions for storing the GVP table such that the GVP table can be accessed for any subsequent synchronization operations involving the video stream; and wherein

the elementary video stream is an MPEG-2 file; and

the markers are GOP markers.

33. The software program product according to claim 26, wherein the elementary audio stream is a constant bit rate file.

34. The software program product according to claim 26, wherein the instructions for finding an audio byte location in the audio stream further comprise instructions for:

determining a total time value for the audio stream that represents an amount of time required to play the entire audio stream at a selected speed;

determining a total bytes value for the audio stream that represents the total number of bytes occupied by the audio stream; and

calculating the audio byte location by multiplying the total bytes value by the selected time position and dividing by the total time value.

ABSTRACT

A method for synchronizing an audio stream with a variable bit rate video stream is performed by sampling a plurality of markers in the video stream to obtain and store a time stamp and a memory stamp for each marker. A user enters a selected time position for the video stream, and a video byte location is found by reviewing the stored values of the time stamps and the memory stamps. An audio byte location is calculated using the selected time position, the total file size of the audio stream, and the total amount of time required to play the audio stream. To play the audio and video streams synchronously, the audio stream is started from the audio byte location, while the video stream is concurrently started from the video byte location.

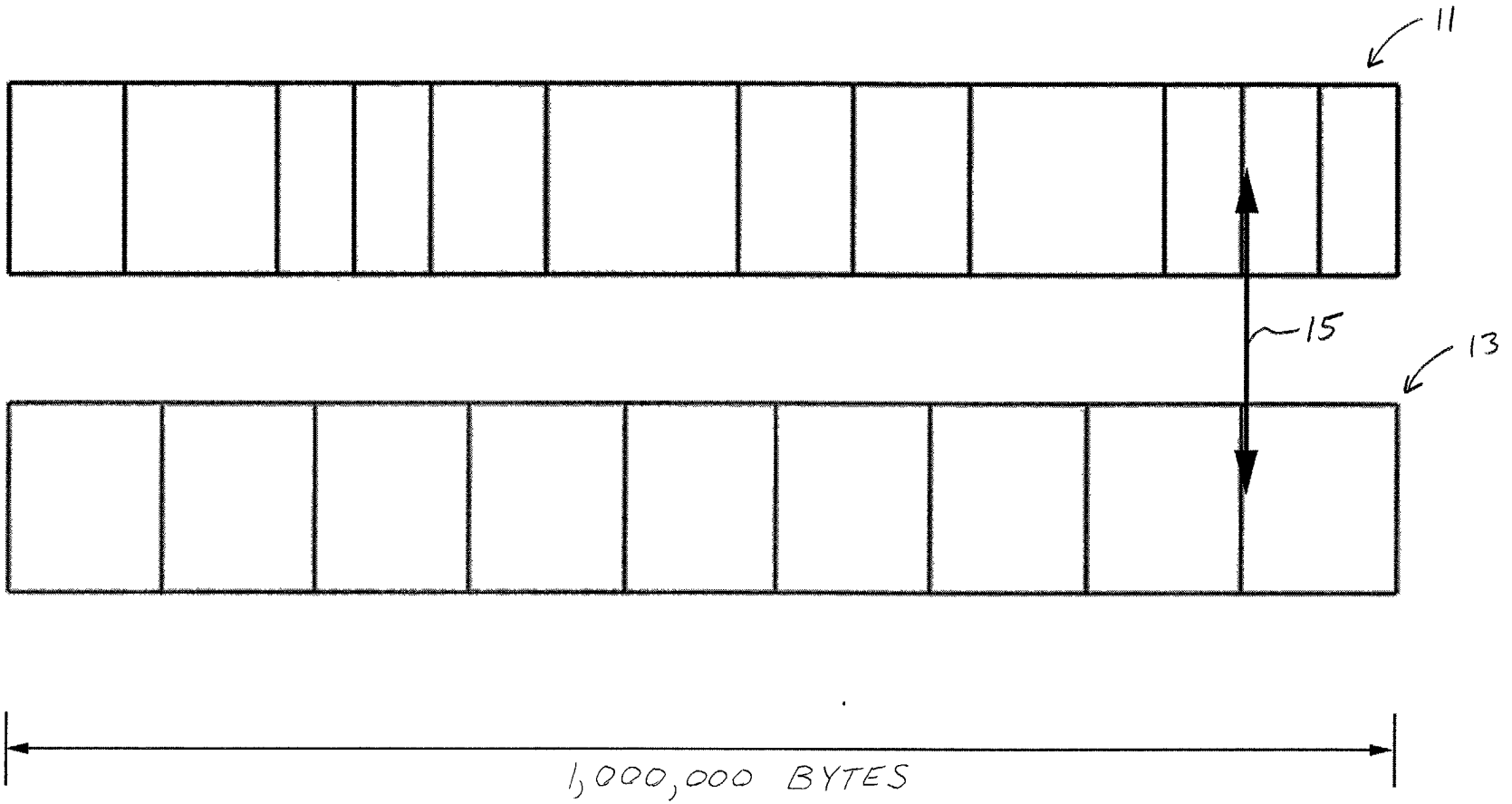


FIG. 1
(PRIOR ART)

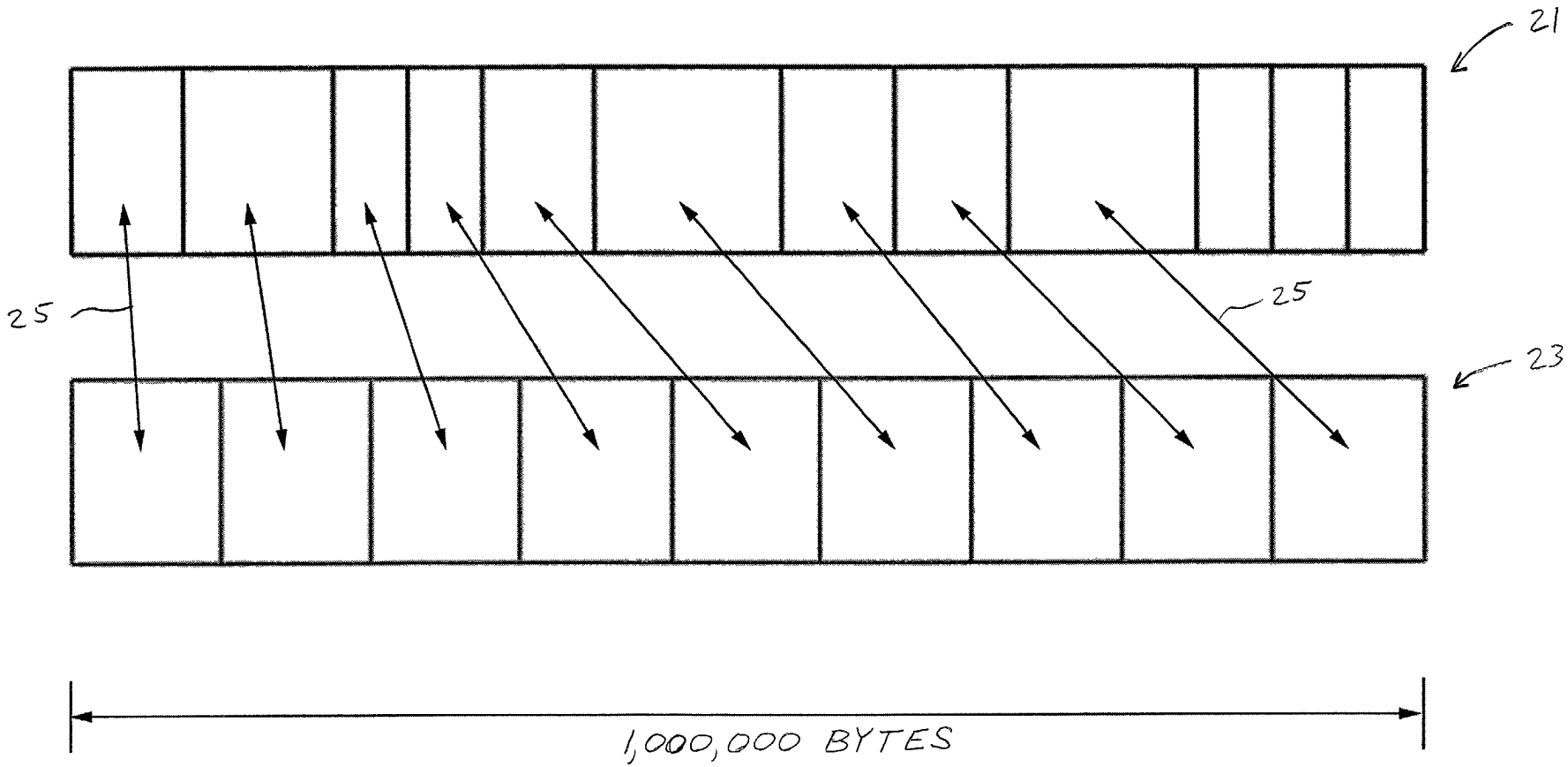


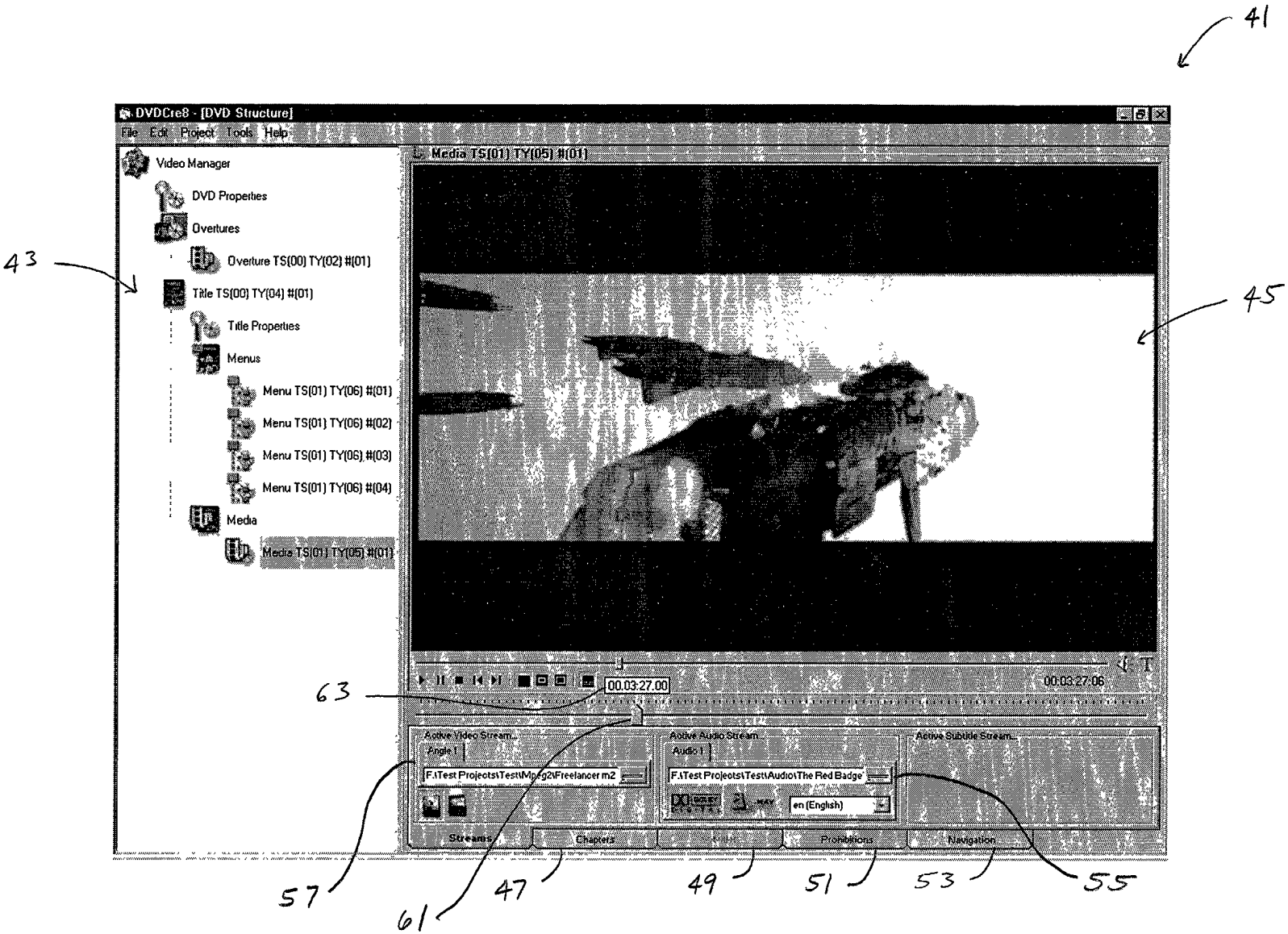
FIG. 2

GVP Table

33 35 31

GOP TIME STAMP	GOP MEMORY STAMP
0.0	H 0000 0000 0000 001E
0.5	H 0000 0000 0000 0028
1.0	H 0000 0000 0000 0030
1.5	H 0000 0000 0000 0041
2.0	H 0000 0000 0000 004A
2.5	H 0000 0000 0000 0050
3.0	H 0000 0000 0000 005F
3.5	H 0000 0000 0000 006E
4.0	H 0000 0000 0000 0078

FIG. 3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43
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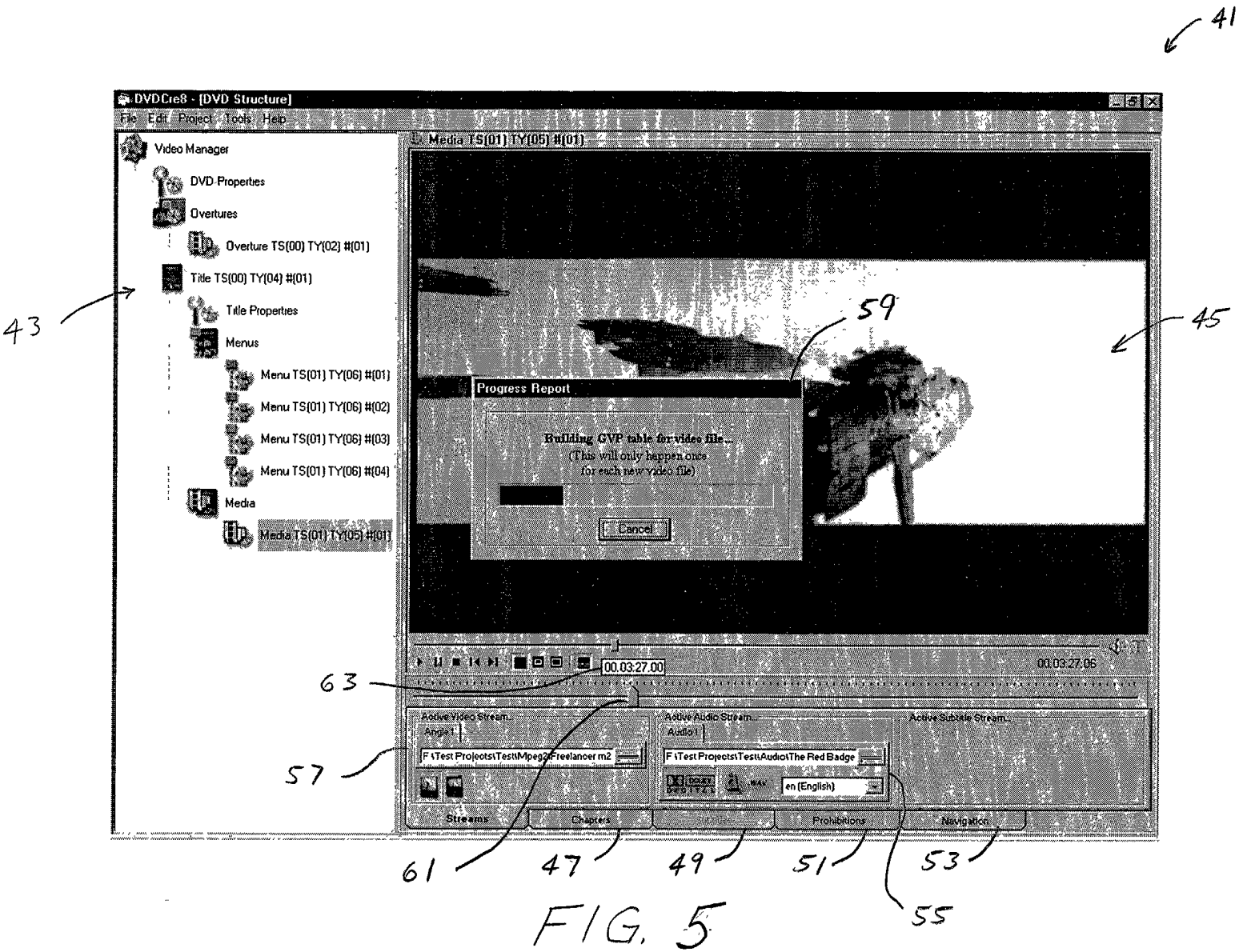
53
55
DVDCre8 - [DVD Structure]
File Edit Project Tools Help
Video Manager
DVD Properties
Overtures
Overture TS(00) TY(02) #(01)
Title TS(00) TY(04) #(01)
Title Properties
Menus
Menu TS(01) TY(06) #(01)
Menu TS(01) TY(06) #(02)
Menu TS(01) TY(06) #(03)
Menu TS(01) TY(06) #(04)
Media
Media TS(01) TY(05) #(01)
Media TS(01) TY(05) #(01)
00:03:27:00
00:03:27:06
Active Video Stream
Angle 1
F:\Test Projects\Test\Mpeg2\Freelancer.m2
Active Audio Stream
Audio 1
F:\Test Projects\Test\Audio\The Red Badge
en (English)
Active Subpic Stream
Streams
Chapters
Prohibitions
Navigation

FIG. 4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DVDCre8 - [DVD Structure]
File Edit Project Tools Help
Video Manager
DVD Properties
Overtures
Overture TS(00) TY(02) #(01)
Title TS(00) TY(04) #(01)
Title Properties
Menus
Menu TS(01) TY(06) #(01)
Menu TS(01) TY(06) #(02)
Menu TS(01) TY(06) #(03)
Menu TS(01) TY(06) #(04)
Media
Media TS(01) TY(05) #(01)
43
Media TS(01) TY(05) #(01)
59
45
Progress Report
Building GVP table for video file...
(This will only happen once
for each new video file)
Cancel
00:03:27:00
00:03:27:06
63
Active Video Stream
Angle 1
F:\Test Projects\Test\Mpeg2\Freelancer.m2
57
Active Audio Stream
Audio 1
F:\Test Projects\Test\Audio\The Red Badge
en (English)
Active Subtitle Stream
Streams
Chapters
Prohibitions
Navigation
61
47
49
51
53
55

FIG. 5

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DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION (37 CFR 1.63)

☑ Declaration Submitted with Initial Filing **OR** ☐ Declaration Submitted after Initial Filing (surcharge (37 CFR 1.16 (e)) required)

Attorney Docket Number	11366.00001
First Named Inventor	Todd M. Porter
COMPLETE IF KNOWN	
Application Number	/
Filing Date	
Group Art Unit	
Examiner Name	

As a below named inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

Method for Synchronizing Audio and Video Streams

(Title of the Invention)

the specification of which
☑ is attached hereto
OR
☐ was filed on (MM/DD/YYYY) _____ as United States Application Number or PCT International Application Number _____ and was amended on (MM/DD/YYYY) _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56.

I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or 365(b) of any foreign application(s) for patent or inventor's certificate, or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or of any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Certified Copy Attached? YES	NO
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐

☐ Additional foreign application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto:

I hereby claim the benefit under 35 U.S.C. 119(e) of any United States provisional application(s) listed below.

Application Number(s)	Filing Date (MM/DD/YYYY)

☐ Additional provisional application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

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DECLARATION — Utility or Design Patent Application

I hereby claim the benefit under 35 U.S.C. 120 of any United States application(s), or 365(c) of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

U.S. Parent Application or PCT Parent Number	Parent Filing Date (MM/DD/YYYY)	Parent Patent Number *(if applicable)*

☐ Additional U.S. or PCT international application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

As a named inventor, I hereby appoint the following registered practitioner(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith: ☐ Customer Number [ ] → *Place Customer Number Bar Code Label here*
OR
☑ Registered practitioner(s) name/registration number listed below

Name	Registration Number	Name	Registration Number
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Peter J. Thoma	28,121	Max Ciccarelli	39,454
Herbert J. Hammond	28,719	Aaron A. Weiss	46,163
Barry W. Dove	45,862		

☐ Additional registered practitioner(s) named on supplemental Registered Practitioner Information sheet PTO/SB/02C attached hereto.

Direct all correspondence to: ☐ Customer Number or Bar Code Label [ ] *OR* ☑ Correspondence address below

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Country	United States	**Telephone**	214-969-1700	**Fax**	214-969-1751

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Name of Sole or First Inventor: ☐ A petition has been filed for this unsigned inventor

Given Name (first and middle [if any])	Family Name or Surname
Todd M.	Porter

Inventor's Signature						**Date**	9/14/00
Residence: City	Dallas	**State**	Texas	**Country**	United States	**Citizenship**	U.S.
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Post Office Address							
City	Dallas	**State**	Texas	**ZIP**	75205	**Country**	United States

☐ Additional inventors are being named on the ____supplemental Additional Inventor(s) sheet(s) PTO/SB/02A attached hereto